Helping Cattle Keep Their Cool

Cattle may not worry about job security or credit history, but that doesn't mean their lives are stress free. For some cattle, rising stress levels correspond with rising temperatures. This can be a problem for the many cattle raised in the Central Plains, a region subject to long periods of extreme heat in the summer.

Heat stress can have serious consequences. While some cattle exhibit little or no response to it, others may experience diminished appetite and feed intake, reduced growth rate, compromised disease resistance, and—in extreme cases—death.

What causes heat stress? The simplest answer is that extremely high temperatures overwhelm an animal's natural ability to regulate its body temperature. But other factors are involved, and understanding them is essential for predicting, preventing, and responding to potential heat-stress scenarios.

Agricultural Research Service scientists at the Roman L. Hruska U.S. Meat Animal Research Center (USMARC) in Clay Center, Nebraska, are working together with scientists at several universities around the world to identify causes of and responses to heat stress in cattle. They are also developing risk-assessment tools and management strategies for producers. This work has three main components: analyzing animal susceptibility, identifying contributing environmental factors, and evaluating management techniques.

Hot or Not? Predicting Animal Susceptibility

Every animal responds to heat stress differently, so USMARC agricultural engineer Tami Brown-Brandl and her colleagues conducted several studies to identify factors that contribute to animal susceptibility. They identified 11 influential factors, including coat color, health history, and temperament.

One study analyzed several factors that influence sweating rate in different breeds of cattle. This is significant because cattle, like humans, sweat to stay cool. Results showed that coat color, wind speed, access to shade, and breed could influence an animal's physical response to heat. For example, scientists observed that Angus cattle adapted to conditions in Kansas had higher body temperatures than those adapted to conditions in Florida. Though genetically similar, the Kansas cattle also had a more erratic sweating rate, suggesting that the Florida cattle are better suited to warmer climates.

Understanding differences like this can help producers anticipate the reaction of individual animals within their herds and respond accordingly. But individual assessments can be complicated and time-consuming. To help, Brown-Brandl worked with University of Nebraska-Lincoln engineer David Jones to develop a model that evaluates the characteristics of individual animals and produces an index value that reflects the susceptibility of each one.

"This value could then be used by producers to sort cattle into different groups so that management schemes could be developed to fit the risk category of each group," Brown-Brandl says.

Such a system would enable more targeted management. And enabling producers to isolate the most susceptible animals for special treatments could reduce casualties.

Hot Models: Mapping Environmental Influences

Identifying other sources of environmental stress is also

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ARS scientists at the Roman L. Hruska U.S. Meat Animal Research Center in Clay Center, Nebraska, are comparing several types of shading material and structures that help alleviate heat stress in cattle raised in outdoor pens. One such method, shown here in Queensland, Australia, uses large openings to help reduce snow and wind loads.

essential for anticipating heat stress and taking action to reduce the consequences. For years, cattle producers turned to the National Weather Service and university websites for livestock weather warnings based on temperature and humidity predictions.

"Temperature and humidity are two key factors contributing to heat stress, but there are factors not reflected in those models that are significant in the stress relationship," says USMARC engineer Roger Eigenberg. "A model that takes those other factors into account could provide more accurate predictions."

To create a more accurate model, Eigenberg and Brown-Brandl worked with USMARC engineer John Nienaber to analyze weather data from significant heat waves and identify environmental factors that contributed to higher incidences of cattle stress.

The result was a heat stress model that incorporates predictions of temperature, humidity, sun intensity, and wind speed. The model predicts when environmental conditions are particularly suited for heat stress, and presents the information in an easy-to-read, color-coded map that includes South Dakota, Nebraska, Iowa, western Colorado, Kansas, Missouri, Oklahoma, and northern Texas. It can be viewed online at www.tinyurl.com/HeatStressModel.

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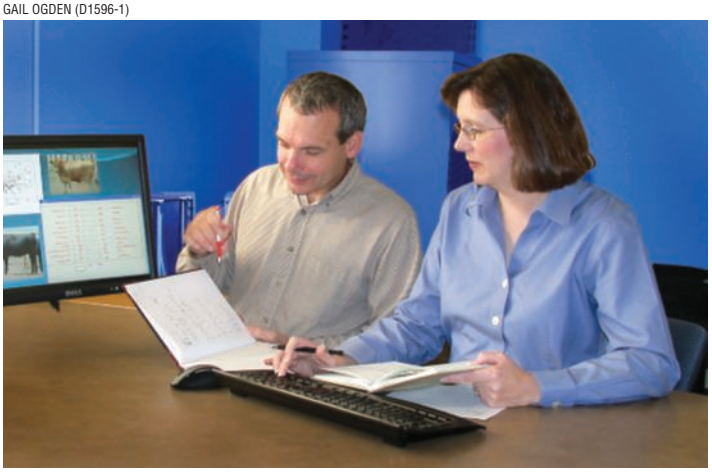

University of Nebraska-Lincoln engineer David Jones (left) and ARS agricultural engineer Tami Brown-Brandl developed a model that evaluates the characteristics of individual animals and produces an index value that reflects each one's susceptibility to heat stress.

Action Figures: Assessing Management Decisions

Models can help producers identify potentially troublesome cattle and conditions, but the information models provide can only reduce heat stress if managers respond to it.

When weather conditions threaten the health of their herds, producers have several options for fighting back. To allay heat stress, they may erect shades, alter the animals' diets, change feeding times, remove wind breaks, or use sprinklers to cool the animals or the ground.

"The problem is that there are costs and drawbacks associated with each of the methods," Brown-Brandl says. "For example, a producer considering sprinkler cooling needs to assess the cost of the equipment, maintenance, and water—as well as the potential for wet soil to generate odors."

Having more information about the potential benefits and disadvantages of stress-alleviation methods can help managers decide how to respond to dangerous heat situations, so the USMARC scientists have evaluated one of the more common management options.

Eigenberg, Nienaber, and Brown-Brandl compared the effects of four commercially available shade materials on cattle raised in outdoor pens. Three of the shades were constructed of solar radiation-blocking polyethylene cloth. The fourth used a porous snow fence that provided some shade, but allowed sunlight to filter through.

The scientists found that all the materials reduced cattle stress. The higher the percentage of solar radiation blocked by the shades, the more effective they were at reducing stress. But all the shades offered some protection that could result in slower respiration rates and lower body temperatures—even the snow fence, which is less expensive than the other shades and offers comparatively less protection.

"Based on these results, we can conclude that erecting shades is indeed an effective method to reduce stress-related losses," Brown-Brandl says.

Research efforts like these have been essential for developing tools and management practices to help cattle producers beat the heat. And that's a relief not just for the cattle, but for the people who work with them as well.—By **Laura McGinnis,** formerly with ARS.

This research is part of Food Animal Production, an ARS national program (#101) described at www.nps.ars.usda.gov.

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